Using Radioiodine Speciation to Address Waste Stream Stabilization Problems at the Fukushima Daiichi Nuclear Power Plant and DOE Sites

PARTNERS

Japan's MEXT

Savannah River National Laboratory (SRNL) and Texas A&M University (TAMU)

This project is developing approaches for stabilizing I-129 from contaminated groundwater and waste streams and the safe disposal of secondary waste generated from the treatment of I-129 waste at DOE sites and the Fukushima Daiichi Advanced Liquid Processing System (ALPS) facility.

Technical Summary

Radioiodine is among the three top risk drivers at DOE's low level waste disposal sites and at the Fukushima Daiichi ALPS facility for the treatment of radionuclide-contaminated groundwater and waste streams. One of the key technical challenges facing these facilities is that the separation of radioiodine from the waste stream is highly dependent on iodine speciation (I-, IO_3-, and organo-iodine). The objective of this study is to develop safe engineering solutions to environmental remediation and waste stream stabilization of radioiodine based on knowledge of iodine speciation. If successful, this project will provide the first measurements of iodine speciation in simulant tank waste, cementitious waste form pore water, ALPS waste streams, and Fukushima groundwater samples. This data will be used to design appropriate stabilization technologies for the overall DOE-EM cleanup mission and accelerated decommissioning of the Fukushima Daiichi Nuclear Power Plant. The project will culminate in the development of a model that can be used to help design systems to implement proposed technologies, either as sorbents or coprecipitation processes. This project is jointly funded by U.S. DOE-EM (funding SRNL and TAMU) and Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT; funding JAEA and Kyushu University).

Path Forward

- Characterize radioiodine speciation in waste streams to provide information for the development of species-specific stabilization technologies.
- Conduct screening tests for low-cost, highly effective sorbents for radioiodine species.
- Conduct multi-year field test of promising geopolymer and cementitious secondary waste stabilization technologies.
- Develop a model for designing treatment systems.

Key Accomplishments

- Held a kick-off meeting with Japanese and US researchers in Yokohama, Japan.
- Identified low-cost, highly efficient sorbents for the long-term disposal of radioiodine as I-, IO_3-, or organo-iodine. These sorbents (organo-clay, chemically modified biochar, and functionalized silicate nanoparticles) bond the radioiodine extremely strongly.
- Initiated studies leading to field trial at the SRS RadFLEx Facility (Radionuclide Field Lysimeter Experiment)

Key Benefits

- Successful demonstration and deployment of this technology will help address a high priority need for the DOE complex (DOE-EM's Engineering & Technology Roadmap) and Japan's Fukushima Daiichi decommissioning program (Mid- and Long-Term Roadmap for TEPCO's FDNPP).
- Reduce uncertainty and risk posed by waste disposal, thereby reducing disposal costs.
- Complete first measurements of radioiodine speciation to be used to target appropriate separation technologies and long-term disposal paths.

For more information on this project or the EM International Program

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